Student Objective
(6.SP.A.3)   Recognize that a measure of center for a numerical data set summarizes all of its values with a single
                    number, while a measure of variation describes how its values vary with a single number.   (Calculator – No)
(6.SP.B.4)   Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (Calculator – No)
(6.SP.B.5)   Summarize numerical data sets in relation to their context, such as by: (Calculator – Yes)
         a.   Reporting the number of observations
         b.   Describing the nature of the attribute under investigation, including how it was measured and its
                   units of measure.
         c.   Giving quantitative measures of center (median and/or mean) and variability (interquartile range
                   and /or mean absolute deviation), as well as describing any overall pattern and any striking
                   deviations from the overall pattern with reference to the context in which the data were gathered.
         d.   Relating the choice of measures of center and variability to the shape of the data distribution and
                   the context in which the data were gathered.

Lesson
Box-and-Whisker Plots

Homework
Box-and-Whisker Plots WS (9 problems)

Bellwork
Teacher Selected

Prior Knowledge
This week, we learned how to find the median and range of a set of numbers. Remember, median is your middle number.
Your range is big number – small number.

Introduction
Today, we will use what we have learned about the median to help us interpret data represented in a box-and-whisker plot.
Why learn about box-and-whisker plots?
Well, when you have a large set of data, sometimes it is useful and easier to interpret if it is broken down into smaller pieces.

Teacher Input
- **Show PowerPoint – Introduction to Box-and-Whisker Plots (Power Point found by Mrs. Stanford on internet)**
- **Pass out Student Notes**
- **Define what a Box-and-Whisker Plot is and the five pieces of data that make it up (*five number summary*):**
  (lower quartile, median, upper quartile, lower extreme, upper extreme)
- **Explain and demonstrate how to construct a box-and-whisker plot by first finding the median, lower quartile, and upper quartile.**
- **Explain and demonstrate how to graph a box-and-whisker plot.**
- **The box consist of:**
  Lower Quartile (Q1)
  Median (Q2)
  Upper Quartile (Q3)
- **The whiskers consist of:**
  Lower Extreme
  Upper Extreme
- **Define the interquartile range (IQR) and how it is calculated. Upper Quartile – Lower Quartile**
  IQR = Q1 – Q2
- **Classwork – can be done independent or as guided practice with the students (Problems 1 – 8)**
- **Extra Practice (Problems 1 – 5 if time permits)**

Closure
Today we talked about a box-and-whisker plot which presents a way to analyze data.

1. The data in a box-and-whisker plot is sometimes called the five summary data. What are the 5 pieces of data?
   lower quartile, median, upper quartile, lower extreme, upper extreme
2. When constructing a box-and-whisker plot what do you find first?   **the median of the entire data set**
3. How do you find the lower quartile?   **Find the median of the lower half of the data**
4. How do you find the upper quartile?   **Find the median of the upper half of the data**
5. What is the lower extreme? **The lowest number in the data set**
6. What is the upper extreme? **The highest number in the data set**
7. How do you calculate the interquartile range (IQR)? **Upper Quartile – Lower Quartile**   ➔ **IQR = Q1 – Q2**

1   What are Box-and-Whisker Plots?

- A box-and-whisker plot can be useful when you have to handle many data values.
- They allow people to explore data and to draw conclusions.
- It shows only certain statistics rather than all the data.
- *Five-number summary* is another name for the visual representations of the box-and-whisker plot. The five-number summary consists of:

1) Lower Quartile (Q1)   **4)** Lower Extreme

2) Median (Q2)   **5)** Upper Extreme

3) Upper Quartile (Q3)

2   Constructing a Box-and-Whisker Plots

The first step in constructing a box-and-whisker plot is to use the given data set to first find the:

median,

lower quartile, and

upper quartile

<u>Example</u>

The following set of numbers is the amount of marbles fifteen different boys own. The numbers are already ordered from least to greatest.

18 27 34 52 54 59 61 68 78 82 85 87 91 93 100

- **First find the *median*. The median is the value in the <u>middle</u> of an ordered set of numbers.**

68 is the median

- **Next, we consider only the values to the left of the median: 18 27 34 52 54 59 61. We now find the median of this set of numbers. 52 is the median of the scores less than the median of all scores, and therefore is the *lower quartile*.**

52 is the lower quartile

- **Now consider only the values to the right of the median: 78 82 85 87 91 93 100. We now find the median of this set of numbers. The median 87 is therefore called the *upper quartile*.**

87 is the upper quartile
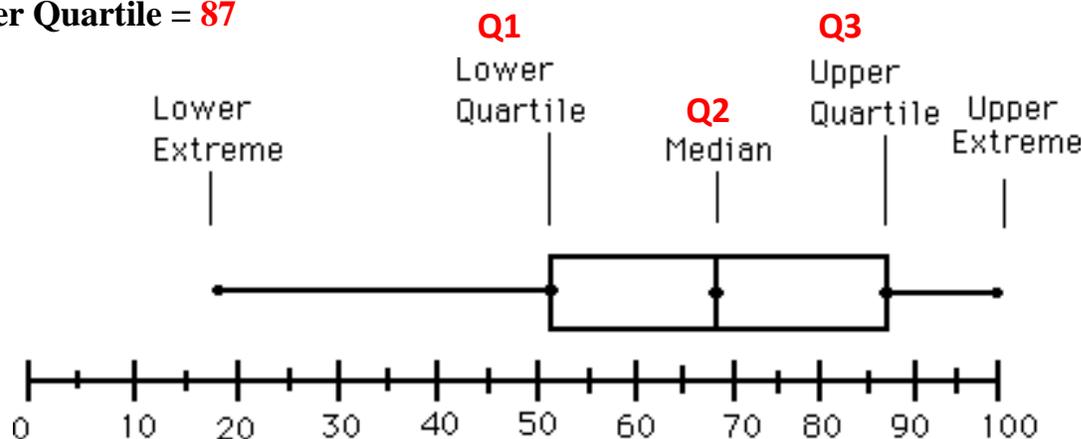
3 **Graphing our Box-and-Whisker Plot**

18 27 34 52 54 59 61 68 78 82 85 87 91 93 100

- **The Box is made up of your:**
  Median = 68
  Lower Quartile = 52
  Upper Quartile = 87

Q1
Lower
Quartile

Q3
Upper
Quartile   Upper
           Extreme

Lower
Extreme

Q2
Median

```
         |----------------------------------|
         |          |           |           |
 0   10  20  30  40  50  60  70  80  90  100
```

- **The Whiskers are made up of your:**
  Lower Extreme = 18
  Upper Extreme = 100

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4 **Finding the Interquartile Range (IQR)**

- **The *interquartile range (IQR)* is the difference between the upper quartile and the lower quartile.**
- **In our case the IQR is 87 − 52 = 35.**
- **The IQR is a very useful measurement because it is less influenced by extreme values!**

35 is the Interquartile Range

Directions: Use the following information to answer Numbers 1 through 8.

The following list shows the number of wins that Roger had in each of his twenty years as a baseball pitcher.

   9, 7, 24, 20, 18, 17, 21, 18, 18, 11, 9, 10, 10, 21, 20, 14, 13, 20, 13, 17

1. Put the number of wins in order from least to greatest.

_____

Box

2. What is the median number of wins? _____

3. What is the lower quartile?_____

4. What is the upper quartile?_____

Whiskers

5. What is the minimum number of wins (*Lower extreme*)?_____

6. What is the maximum number of wins (*Upper extreme*)?_____

7. Display the data in a box-and-whisker plot. Draw the plot below the number line.

Number of Wins

```
◄──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──►
    7  8  9  10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
```
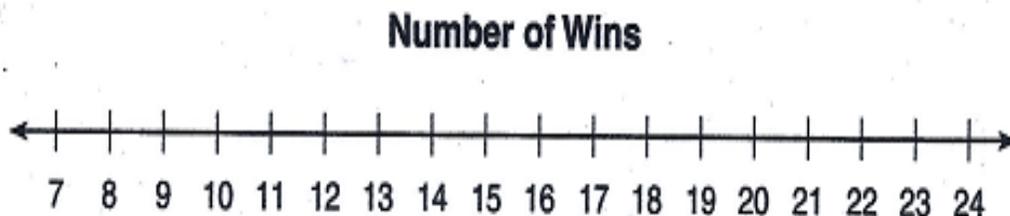
8. What is the interquartile range (IQR)?_____

    What is the range between the two extremes? _____

1) Mean = _____

Median = _____

Range = _____

2) Which of the following MUST you order your numbers to get the right answer:

Mean   Median   Range

3) North Dakota has very cold temperatures.
Find the mean, median, mode, and range of the temperatures recorded below:

10°, 12°, 29°, 2°, 19°, 42°, 23°, 23°

Mean: _____° Median: _____° Range: _____°

4) North Dakota has very cold temperatures.
The following temperatures were recorded for a period of eight days.

10°, 12°, 29°, 2°, 19°, 42°, 23°, 23°

If on the ninth day the temperature was recorded at 20º which of the following would have the **greatest** change?

A. Mean   B. Median   C. Range   D. They are all changed by the same amount

5) The following shows the number of footbal games each team won.
Construct a box-and-whisker plot using the data in the table.

Team	Games Won
Bulldogs	8
Wildcats	10
Panthers	5
Eagles	6
Tigers	7
Bears	2
Yellow Jackets	8

1) Lower Quartile (Q1) = _____
2) Median (Q2) = _____
3) Upper Quartile (Q3) = _____
4) Lower Extreme = _____
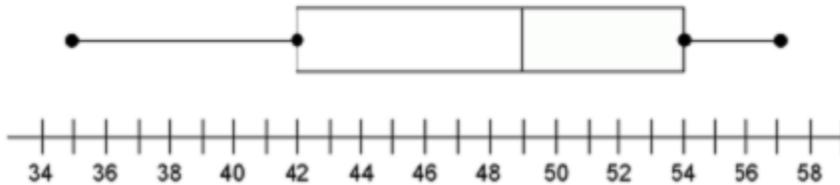5) Upper Extreme = _____
6) Interquartile Range (IQR) = _____
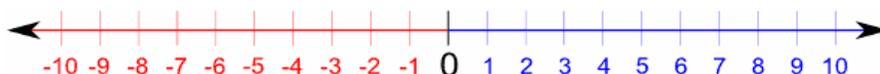
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

1) A box plot was made from some data.

Find the median _____, the 1st quartile _____, the 3rd quartile _____,

the minimum _____, the maximum _____, and the range _____.

2) Make three box-and-whisker plots from the following data sets. Use the number line below to draw each plot.

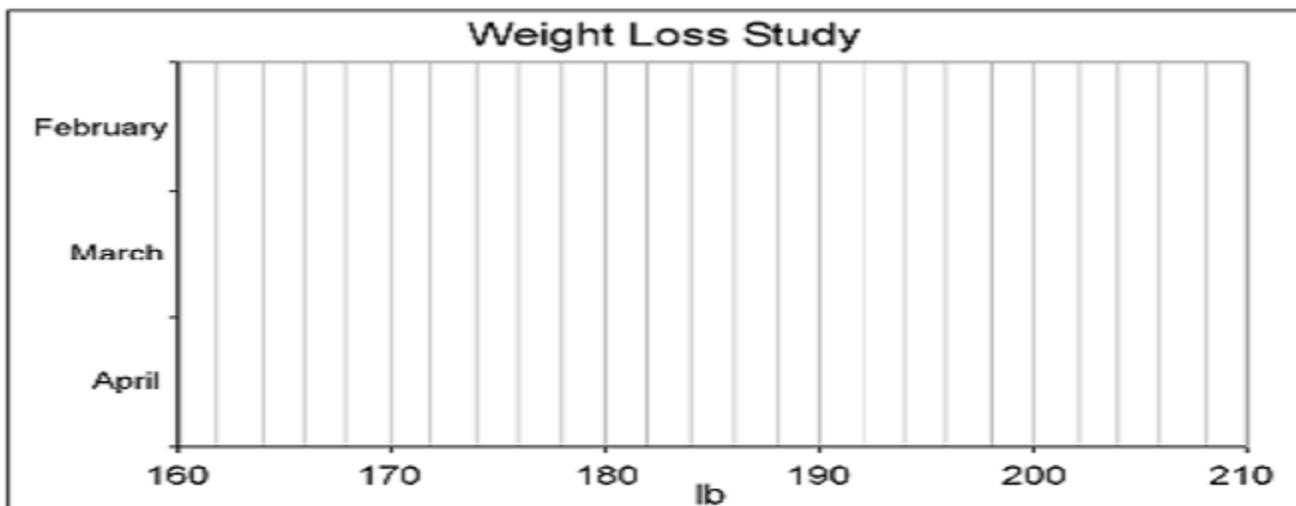A. Initial weights (February) of 14 people in a weight loss study (in pounds):

189 176 186 200 204 188 175 179 188 190 194 187 195

B. Weights of the same people one month later (March):

186 172 180 190 195 179 173 177 180 187 187 190 184 190

C. Weights of the same people two months later (April):

180 166 175 183 189 177 170 171 170 184 188 182 180 185

3) The box-and-whisker plot shows the profits of a software company (in million dollars) in the last ten years. Find the median profit of the company.
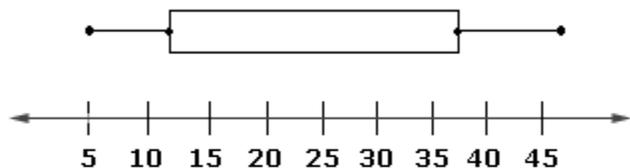

A. $25 million   B. $20 million

C. $10 million   D. $15 million

4) The box-and-whisker plot shows the earnings (in dollars) of a daily wage earner. Find the range of his earnings.
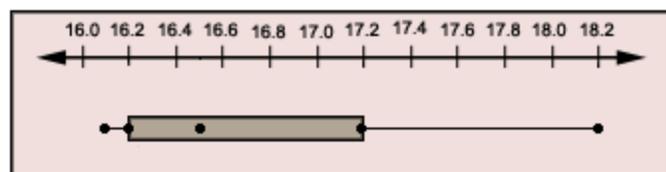

A. $125   B. $200

C. $150   D. $100

5) Find the interquartile range from the given box-and-whisker plot.
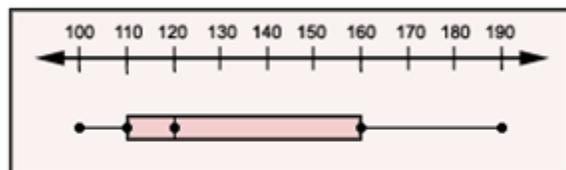

A. 37.5   B. 12.5   C. 25   D. 50

6) The box-and-whisker plot shows the distance covered (in kilometers) during a benefit walk. What is the range of the data?

A. 1.5   B. 2.5   C. 4.5   D. 2.1

7) The box-and-whisker plot shows the number of petals of each flower in a garden. What is the difference between the greatest value and the lower quartile of the plot?

A. 100   B. 120   C. 110   D. 80

8. The scores of students in a math test are 20, 2, 3, 5, 7, 8, 10, 13, 17, 8, and 6. What is the middle quartile of the data?

A. 2   B. 20   C. 7   D. 8

9) The owner of a supermarket recorded the number of customers who came into his store each hour for one day. The results were 16, 11, 13, 10, 17, 6, 9, 10, 16, 11, and 12. Find the interquartile range.

A. 6   B. 10   C. 15   D. 9

Directions: Use the following information to answer Numbers 1 through 8.

The following list shows the number of wins that Roger had in each of his twenty years as a baseball pitcher.

9, 7, 24, 20, 18, 17, 21, 18, 18, 11, 9, 10, 10, 21, 20, 14, 13, 20, 13, 17

1. Put the number of wins in order from least to greatest.

7, 9, 9, 10, 10, 11, 13, 13, 14, (17 ¦ 17) 18, 18, 18, 20, 20, 20, 21, 21, 24

Box

2. What is the median number of wins? __17__

3. What is the lower quartile? __10.5__   ⑦⑨⑨⑩ 10 11 ⑬⑬⑭⑰
   21÷2

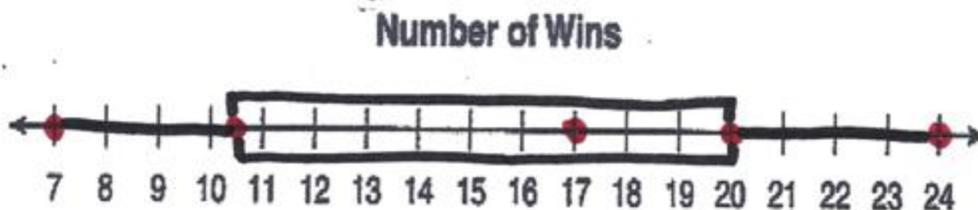4. What is the upper quartile? __20__

   ⑰⑱⑱⑱ 20 20 ⑳㉑㉑㉔
   40÷2

Whiskers

5. What is the minimum number of wins (*Lower extreme*)? __7__

6. What is the maximum number of wins (*Upper extreme*)? __24__

7. Display the data in a box-and-whisker plot. Draw the plot below the number line.

Number of Wins

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

8. What is the interquartile range (IQR)? __9.5__   20−10.5

   What is the range between the two extremes? __17__   24−7

1)   Mean = _____   **Average**

   Median = _____   **Middle**

   Range = _____   **Big – Small**

2)   Which of the following MUST you order your numbers to get the right answer:

   Mean   **Median**   Range

3)   North Dakota has very cold temperatures.
   Find the mean, median, mode, and range of the temperatures recorded below:

   10°, 12°, 29°, 2°, 19°, 42°, 23°, 23°

   Mean: __20__°   Median: ___21__°   Range: __40___°

4)   North Dakota has very cold temperatures.
   The following temperatures were recorded for a period of eight days.

   10°, 12°, 29°, 2°, 19°, 42°, 23°, 23°

   If on the ninth day the temperature was recorded at 20° which of the following
   would have the **greatest** change?

   A. Mean   **B. Median**   C. Range   D. They are all changed by the same amount

5)   The following shows the number of footbal games each team won.
   Construct a box-and-whisker plot using the data in the table.

Team	Games Won
Bulldogs	8
Wildcats	10
Panthers	5
Eagles	6
Tigers	7
Bears	2
Yellow Jackets	8

1) Lower Quartile (Q1) = ___5____
2) Median (Q2) = ___7____
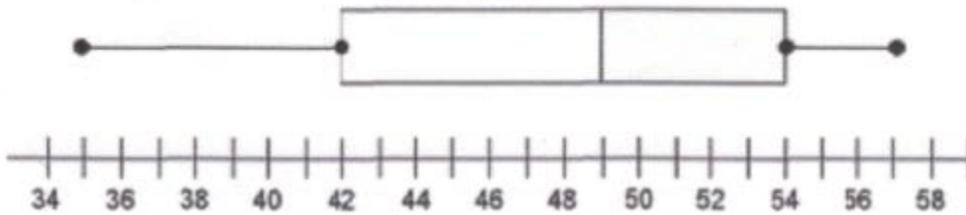3) Upper Quartile (Q3) = ___8____
4) Lower Extreme = ___2____
5) Upper Extreme = ___10____
6) Interquartile Range (IQR) = ___8____

1. A boxplot was made from some data.

Find the median __49__, the 1ˢᵗ quartile __42__, the 3ʳᵈ quartile __54__,

the minimum __35__, the maximum __57__, and the range __22__.

2. Make a box-and-whisker plot from the following data sets.

A. Initial weights (February) of 14 people in a weight loss study (in pounds):

~~189~~ ~~176~~ ~~186~~ ~~200~~ ~~204~~ ~~188~~ ~~175~~ ~~179~~ ~~188~~ ~~190~~ ~~194~~ ~~187~~ ~~195~~

175 176 179 186 187 188 188 189 190 194 195 200 204
median 188   1ˢᵗ q 182.5   3ʳᵈ 194.5   min 175 max. 204 range 29

B. Weights of the same people one month later (March):

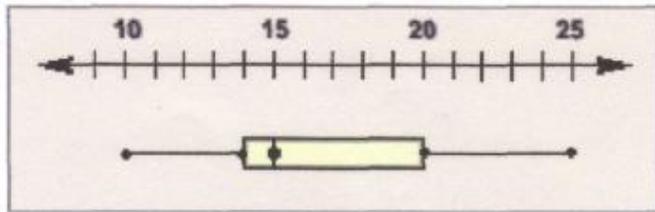186 172 180 190 195 179 173 177 180 187 187 190 184 190

172 173 177 179 180 180 184 186 187 187 190 190 190 195
med 186   1ˢᵗ q. 178   3ʳᵈ 190 min 172 max 195 range 23

C. Weights of the same people two months later (April):

166 170 170 171 175 177 180 180 182 183 184 185
180 166 175 183 189 177 170 171 170 184 188 182 180 185
med. 178.5 1ˢᵗ 170 3ʳᵈ 183 min 166 max 185 range 19
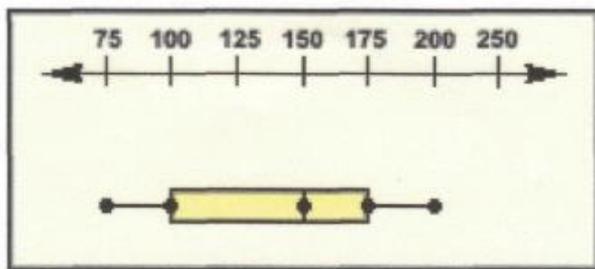

Weight Loss Study

3. The box-and-whisker plot shows the profits of a software company (in million dollars) in the last ten years. Find the median profit of the company.
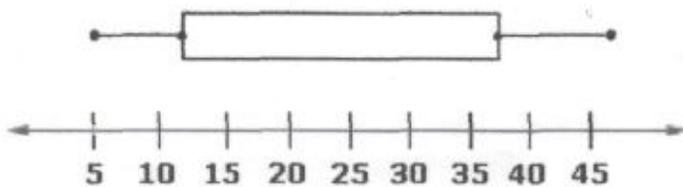

A. $25 million   B. $20 million

C. $10 million   D. $15 million

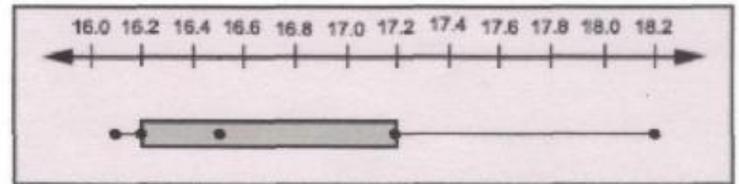4. The box-and-whisker plot shows the earnings (in dollars) of a daily wage earner. Find the range of his earnings.

A. $125   B. $200

C. $150   D. $100

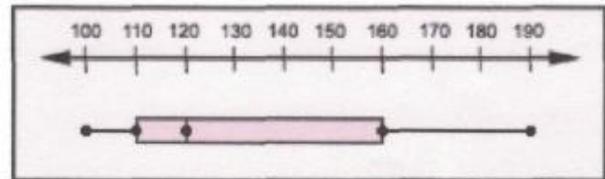5. Find the interquartile range from the given box-and-whisker plot.

A. 37.5   B. 12.5   C. 25   D. 50

6. The box-and-whisker plot shows the distance covered (in kilometers) during a benefit walk. What is the range of the data?

A. 1.5   B. 2.5   C. 4.5   D. 2.1

7. The box-and-whisker plot shows the number of petals of each flower in a garden. What is the difference between the greatest value and the lower quartile of the plot?

A. 100   B. 120   C. 110   D. 80

8. The scores of students in a math test are 20, 2, 3, 5, 7, 8, 10, 13, 17, 8, and 6. What is the middle quartile of the data?

A. 2   B. 20   C. 7   D. 8

9. The owner of a supermarket recorded the number of customers who came into his store each hour for one day. The results were 16, 11, 13, 10, 17, 6, 9, 10, 16, 11, and 12. Find the interquartile range.

A. 6   B. 10   C. 15   D. 9